

EC2400: Computer Assignment 1

Fall AY2002

Goals:

- Understand the relationship between analog frequency and digital frequency;
- Understand the concept of aliasing for sinusoidal signals

Help on the Web:

The Web site <http://www.dsptutor.freeuk.com/aliasing/AD102.html> shows an applet which helps you understand the concepts in this assignment. You can compare your results with the results of the applet.

Problem 1. Generate a sampled sinusoid with the following characteristics:

<i>Amplitude</i>	$A = 10$
<i>Frequency</i>	$F_0 = 0.9kHz$
<i>Phase</i>	$a = 30^\circ$
<i>Sampling Frequency</i>	$F_s = 8kHz$
<i>Length</i>	$300msec$

Q1: Determine the digital frequency and plot the signal. Just plot a few cycles;

Q2: Find another sinusoid with frequency between $F_s/2$ and F_s having the same samples.

Determine its digital frequency, amplitude, phase and plot the sequence. Verify that the samples are the same as the previous one.

Problem 2. The seven musical notes C, D, E, F, G, A, B have the following frequencies (all in Hz):

$$F_C = 262, F_D = 294, F_E = 330, F_F = 349, F_G = 392, F_A = 440, F_B = 494$$

Q1: Assuming a sampling frequency $F_s = 8kHz$, for each note determine the digital frequency and generate a vector of length $1/4$ sec. Call each vector by the name of the note (C, D, \dots).

Q2: Make a vector p of *zeros* of length $N/10$, which represents a short pause between the notes, and then make a vector called X with the following sequence of notes

$$C, p, D, p, E, p, F, p, G, p, A, p, B, p$$

Play the vector on the sound card, using the command *sound*.

Q3: Play the same vector X in the previous question at a different sampling frequency, say $F_s = 11kHz$. See how it sounds. In this case, what are the analog frequencies you hear for each note C, \dots, B ?

Matlab Commands:

<i>n=1:N</i>	to generate a vector <i>n</i> of indices from 1 to N
<i>plot</i>	to plot a vector on the screen;
<i>zeros</i>	to obtain a vector (or a matrix) of zeros;
<i>sound</i>	to play a sound on the sound card;

Do not use "for" loops to generate a sequence. Most commands (like "cos" or "sin") give a vector of data when the argument is a vector.